UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/622,848	07/18/2003	Norman L. Oberski	A126.113.102	4765

25281 7590 11/16/2005

DICKE, BILLIG & CZAJA, P.L.L.C.
FIFTH STREET TOWERS
100 SOUTH FIFTH STREET, SUITE 2250
MINNEAPOLIS, MN 55402

EXAMINER
MONBLEAU, DAVIENNE N

ART UNIT	PAPER NUMBER
2878	

DATE MAILED: 11/16/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

H·A

Office Action Summary	Application No.	Applicant(s)	
	10/622,848	OBERSKI ET AL.	
	Examiner	Art Unit	
	Davienne Monbleau	2878	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *05 July 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-21* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-21* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *18 July 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *9/26/05*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

The amendment filed on 7/5/05 has been entered. Claims 1-6 and 11 have been amended. Claims 1-21 are pending.

The newly submitted abstract of the disclosure remains objected to because it does not accurately portray the features of the claimed invention. The abstract should at least mention the mapping of height data from the sample and how that is used for focusing the inspection system. Correction is required. See MPEP § 608.01(b).

Information Disclosure Statement

The IDS filed on 9/26/05 has been acknowledged and a signed copy of the PTO-1449 is attached herein.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-5, 8-14, and 18-21 are rejected under 35 U.S.C. 102(b) as being anticipated by Watanabe et al. (U.S. 6,17,637).

Regarding Claim 1, *Watanabe* discloses in Figure 2 an inspection system comprising a primary optical inspection device (100) including a focusing mechanism (103) for optically inspecting a sample (106), and an auxiliary sensor (200) for mapping a sample height by

obtaining height data for at least one point on the sample (106) apart from the focusing mechanism (103). (See also column 2, lines 11-45.)

Regarding Claim 2, *Watanabe* discloses (column 16, lines 44-48 that the height data is used to position the inspection device (100) in focus during an inspection of the sample (106).

Regarding Claim 3, *Watanabe* discloses (column 45, lines 40-55) that the height data is used in an interpolation to calculate an exact height of each picture needed for the inspection of the sample (106) by the inspection device (100). (See also column 1, lines 20-26.)

Regarding Claim 4, *Watanabe* discloses (column 16, lines 44-48) that mapping the sample height is performed as a separate operation before the inspection of the sample (106) by the inspection device (100) occurs.

Regarding Claim 5, *Watanabe* discloses (column 18, lines 22-29) that the process of mapping the sample height is performed concurrent with inspection of the sample (106) by the inspection device (100).

Regarding Claim 8, *Watanabe* discloses (column 15, lines 57-65) that the height data comprises a pattern comprising a constant point.

Regarding Claim 9, *Watanabe* discloses in Figure 2 a calibrator (109) for finding the offset between the auxiliary sensor (200) and an inspection lens (103).

Regarding Claim 10, *Watanabe* discloses in Figure 2 that the auxiliary sensor (200) comprises a 3D point sensor (200a).

Regarding Claim 11, *Watanabe* discloses in Figure 2 an inspection system comprising a camera (104, 122, 124) for inspecting a wafer (106) and a 3D point sensor (200) for determining

the heights of a plurality of points (column 1, lines 20-26) on the wafer surface (106) before the wafer (106) is inspected by the camera (104, 122, 124), wherein the heights of the plurality of points on the wafer surface (106) are used for setting the focus of the camera (column 2, lines 35-45.)

Regarding Claim 12, *Watanabe* discloses in Figure 2 an inspection platform (105) for holding the wafer (106) while the wafer (106) is inspected.

Regarding Claim 13, *Watanabe* discloses in Figure 2 a wafer alignment device (107) coupled to the inspection platform (105) for moving the inspection platform (105) relative to the camera (104, 122, 124).

Regarding Claim 14, *Watanabe* discloses in Figure 2 an objective (103) for use with the camera (104, 122, 124) for inspecting the wafer (106).

Regarding Claim 18, *Watanabe* discloses in Figure 2 a method for inspecting a wafer (18) comprising providing an inspection sensor (100), providing an auxiliary sensor (200), obtaining height data of a surface of the wafer (106) using the auxiliary sensor (200), and inspecting the surface of the wafer (106) by focusing the inspection sensor (100) using the height data. (See also column 2, lines 11-45.)

Regarding Claim 19, *Watanabe* discloses in Figure 2 that inspection sensor (100) comprises a camera (104, 122, 124).

Regarding Claim 20, *Watanabe* discloses in Figure 2 that inspecting the surface of the wafer (106) by focusing the inspection sensor (100) using the height data comprises interpolating

the height data to determine heights at which to take pictures of the wafer (106). (See also column 1, lines 20-26; column 45, lines 40-55.)

Regarding Claim 21, *Watanabe* discloses in Figure 2 that the auxiliary sensor (200) comprises a 3D point sensor (200a).

Claims 1, 2, 4, 8, and 18 are rejected under 35 U.S.C. 102(b) as being anticipated by McCord et al. (U.S. 6,597,006).

Regarding claim 1, *McCord* discloses in Figure 2a an inspection system comprising a primary optical inspection device (column 1, lines 60-63; column 7 lines 38-42) including a focusing mechanism (column 13, lines 54-59) for optically inspecting a sample (112), and an auxiliary sensor (22a, 22B) for mapping a sample height by obtaining height data for at least one point on the sample (112) apart from the focusing mechanism.

Regarding Claim 2, *McCord* discloses (column 13, lines 54-59) that the height data is used to position the inspection device in focus during an inspection of the sample (112).

Regarding Claim 4, *McCord* discloses (column 13, lines 54-59) that mapping the sample height is performed as a separate operation before the inspection of the sample (112) by the inspection device occurs.

Regarding Claim 8, *McCord* discloses in Figure 2a that the height data comprises a pattern comprising a constant point.

Regarding Claim 18, *McCord* discloses in Figure 2 a method for inspecting a wafer (112) comprising providing an inspection sensor (column 1, lines 60-63; column 7 lines 38-42), providing an auxiliary sensor (22a, 22b), obtaining height data of a surface of the wafer (112)

using the auxiliary sensor (22a, 22b), and inspecting the surface of the wafer (112) by focusing the inspection sensor using the height data. (See also column 13, lines 54-59.)

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1-6 and 8-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Watanabe in view of McCord.

Regarding Claim 1, *Watanabe* teaches in Figure 2 an inspection system comprising a primary inspection device (100) including a focusing mechanism (103) for inspecting a sample (106), and an auxiliary sensor (200) for mapping a sample height by obtaining height data for at least one point on the sample (106) apart from the focusing mechanism (103). (See also column 2, lines 11-45.) *Watanabe* teaches that the inspection device is a scanning electron beam device, not an optical inspection device. *McCord* teaches (column 1, line 54 to column 2, line 7) that

optical inspection devices (i.e. optical microscopes) and scanning electron inspection devices require high resolution and accurate focusing and can both be used to detect defects in semiconductor surfaces. *McCord* further teaches (column 3, lines 1-32) that height sensors may be utilized in such inspection device to ensure proper positioning, and hence focusing, of the device. Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to apply the inspection device in *Watanabe* to an optical inspection system, as taught by *McCord*, to provide accurate and real-time focusing of the inspection device.

Regarding Claim 2, *Watanabe* teaches (column 16, lines 44-48 that the height data is used to position the inspection device (100) in focus during an inspection of the sample (106).

Regarding Claim 3, *Watanabe* teaches (column 45, lines 40-55) that the height data is used in an interpolation to calculate an exact height of each picture needed for the inspection of the sample (106) by the inspection device (100). (See also column 1, lines 20-26.)

Regarding Claim 4, *Watanabe* teaches (column 16, lines 44-48) that mapping the sample height is performed as a separate operation before the inspection of the sample (106) by the inspection device (100) occurs.

Regarding Claim 5, *Watanabe* teaches (column 18, lines 22-29) that the process of mapping the sample height is performed concurrent with inspection of the sample (106) by the inspection device (100).

Regarding Claim 6, *Watanabe* teaches in Figure 2 measuring the height of sample points on a wafer (106) and averaging them, but does not teach measuring the difference in height of features on the wafer (106). *McCord* teaches (column 18, lines 54-65) measuring height difference of the features. It would have been obvious to one of ordinary skill in the art at the

time of the invention to measure height differences of the features in *Watanabe*, as taught by *McCord*, to reduce pattern-induced error in height measurements.

Regarding Claim 8, *Watanabe* teaches (column 15, lines 57-65) that the height data comprises a pattern comprising a constant point.

Regarding Claim 9, *Watanabe* teaches in Figure 2 a calibrator (109) for finding the offset between the auxiliary sensor (200) and an inspection lens (103).

Regarding Claim 10, *Watanabe* teaches in Figure 2 that the auxiliary sensor (200) comprises a 3D point sensor (200a).

Regarding Claim 11, *Watanabe* teaches in Figure 2 an inspection system comprising a camera (104, 122, 124) for inspecting a wafer (106) and a 3D point sensor (200) for determining the heights of a plurality of points (column 1, lines 20-26) on the wafer surface (106) before the wafer (106) is inspected by the camera (104, 122, 124), wherein the heights of the plurality of points on the wafer surface (106) are used for setting the focus of the camera (column 2, lines 35-45.)

Regarding Claim 12, *Watanabe* teaches in Figure 2 an inspection platform (105) for holding the wafer (106) while the wafer (106) is inspected.

Regarding Claim 13, *Watanabe* teaches in Figure 2 a wafer alignment device (107) coupled to the inspection platform (105) for moving the inspection platform (105) relative to the camera (104, 122, 124).

Regarding Claim 14, *Watanabe* teaches in Figure 2 an objective (103) for use with the camera (104, 122, 124) for inspecting the wafer (106).

Regarding Claim 15, *Watanabe* teaches in Figure 2 that said 3D point sensor (200a) and objective (103) have a field of view and further teaches (column 2, lines 30-45) that the focusing is done prior to inspection, but does not teach how the field of views relate to each other. It would have been obvious, however, to one of ordinary skill in the art at the time of the invention to use particular field of views in *Watanabe* to eliminate the need for focusing during inspection of the wafer in order to increase operation and cost efficiency. If the 3D sensor has a better depth of field than the objective, then a slight change in the height detection would not necessarily require re-focusing of the objective.

Regarding Claim 16, *Watanabe* teaches in Figure 2 an objective (103) but does not teach a plurality of selectable objectives. It would have been obvious, however, to one of ordinary skill in the art at the time of the invention to use a plurality of selectable objectives in *Watanabe* to accommodate a wider range of field of views, thus enabling inspection of many different kinds of samples with different resolution requirements.

Regarding Claim 17, *Watanabe* teaches a 3D point sensor (200a) but does not teach that is confocal. It would have been obvious, however, to one of ordinary skill in the art at the time of the invention to use a confocal sensor in *Watanabe* to minimize the number of optical components required and achieve high resolution.

Regarding Claim 18, *Watanabe* teaches in Figure 2 a method for inspecting a wafer (18) comprising providing an inspection sensor (100), providing an auxiliary sensor (200), obtaining height data of a surface of the wafer (106) using the auxiliary sensor (200), and inspecting the

surface of the wafer (106) by focusing the inspection sensor (100) using the height data. (See also column 2, lines 11-45.)

Regarding Claim 19, *Watanabe* teaches in Figure 2 that inspection sensor (100) comprises a camera (104, 122, 124).

Regarding Claim 20, *Watanabe* teaches in Figure 2 that inspecting the surface of the wafer (106) by focusing the inspection sensor (100) using the height data comprises interpolating the height data to determine heights at which to take pictures of the wafer (106). (See also column 1, lines 20-26; column 45, lines 40-55.)

Regarding Claim 21, *Watanabe* teaches in Figure 2 that the auxiliary sensor (200) comprises a 3D point sensor (200a).

Claims 15-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Watanabe.

Regarding Claim 15, *Watanabe* teaches in Figure 2 that said 3D point sensor (200a) and objective (103) have a field of view and further teaches (column 2, lines 30-45) that the focusing is done prior to inspection, but does not teach how the field of views relate to each other. It would have been obvious, however, to one of ordinary skill in the art at the time of the invention to use particular field of views in *Watanabe* to eliminate the need for focusing during inspection of the wafer in order to increase operation and cost efficiency. If the 3D sensor has a better depth of field than the objective, then a slight change in the height detection would not necessarily require re-focusing of the objective.

Regarding Claim 16, *Watanabe* teaches in Figure 2 an objective (103) but does not teach a plurality of selectable objectives. It would have been obvious, however, to one of ordinary

skill in the art at the time of the invention to use a plurality of selectable objectives in *Watanabe* to accommodate a wider range of field of views, thus enabling inspection of many different kinds of samples with different resolution requirements.

Regarding Claim 17, *Watanabe* teaches a 3D point sensor (200a) but does not teach that is confocal. It would have been obvious, however, to one of ordinary skill in the art at the time of the invention to use a confocal sensor in *Watanabe* to minimize the number of optical components required and achieve high resolution.

Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Watanabe in view of McCord.

Regarding Claim 6, *Watanabe* teaches in Figure 2 measuring the height of sample points on a wafer (106) and averaging them, but does not teach measuring the difference in height of features on the wafer (106). *McCord* teaches (column 18, lines 54-65) measuring height difference of the features. It would have been obvious to one of ordinary skill in the art at the time of the invention to measure height differences of the features in *Watanabe*, as taught by *McCord*, to reduce pattern-induced error in height measurements.

Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Watanabe in view of McCord, as applied to Claim 6 above, and in further view of O'Dell et al. (U.S. 6,324,298).

Regarding Claim 7, *Watanabe* in view of *McCord* teaches an inspection device for wafer defects, but does not teach that the defect/feature is a gold or solder interconnect. *O'Dell* teaches (column 1, lines 12-26) an automated wafer defect inspection system wherein the detected features may be "bump or bond pad area defects such as gold or solder bump defects or similar interconnect defects." It would have been obvious to one of ordinary skill in the art at the time

of the invention to detect defects interconnect features in *Watanabe*, as taught by *O'Dell*, to inspect a semiconductor device with plural components.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure because they teach various wafer/semiconductor inspection devices with height measurement components for adjusting focusing.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Davienne Monbleau whose telephone number is 571-272-1945. The examiner can normally be reached on Monday through Friday 9-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Georgia Epps can be reached on 571-272-2328. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Davienne Monbleau

DNM

Stephone B. Allen
Primary Examiner